FORECASTING FAILURES IN COLLEGE CLASSES

HARVEY B. LEMON
University of Chicago

It is to be hoped that by now the intelligence test as a preliminary and tentative device for classifying individuals of entirely unknown characteristics has come into its own. The rather unrestrained enthusiasm which was displayed by some in the early days of its use has given way to more sober, critical judgment.

The writer has found the use of a certain limited type of intelligence test of considerable value in the administration of undergraduate work in general physics at the University of Chicago. He cannot claim any orthodox background or training in the field of education other than that supplied by a number of years of experience as a teacher of college classes in his own field. This has been coupled with an interest in individuals and their peculiar problems from which he has derived much benefit. In the effort to save, with many hundreds of students, something of that personal contact which is possible with a few score, the methods outlined below have been developed.

Specifically, the problem has been that of co-ordinating six to ten sections of college physics each quarter so that the material covered is essentially the same in all. Special cases requiring individual attention must be discovered as early as possible. There must be uniformity in policy involving credit. Cases of advanced-standing claims and make-up work involving partial repetition of the course must be consistently handled. On the other hand, complete delegation of the teaching responsibility has to be made and complete freedom of action given to the responsible individual. A changing group of teachers, while retaining their individuality as units, must be turning out meanwhile a rather standardized quantity production. The centralization of responsibility and the complete freedom of the individual instructor are regarded as of the greatest importance.

An instructor conducts all of the laboratory exercises, having the services of an assistant if there are more than twelve students in the section; the assistant, however, is not responsible for results; he only helps the instructor, who should be present the entire period. All class work, recitations, problem discussions, and quizzes are conducted by the instructor. There is little "lecturing." Since each section is limited to twenty-four, personal contact of instructor with students is quite possible and will always be attained sooner or later. Sometimes, however, it is not established soon enough, and a poor student drifts along a week or so, sinking deeper every day, until he is unable to overcome his difficulties and it is too late for him to transfer to another course already started. Here lies the need for a preliminary test.

This centralization of responsibility, of course, takes time and effort on the part of the instructor. It appears that one man ought to have not more than one section, so that there will be time for more advanced courses or research. To co-ordinate the work, there ought to be frequent conferences, at least bi-weekly, of instructors of the various sections. In addition, all sections meet together one day a week for a demonstration lecture which is supplementary to the daily work of the sections. Of course, it deals with topics germane to the laboratory work. Its function has been described fully elsewhere.[1]

On entering any section of these courses, the student is required to fill in an information card, the form of which is given on page 384. It will be noted that in addition to the information desired about age, class, degree sought, etc., inquiry is made as to where, when, and from what books high-school physics was studied, and also as to the background in mathematics and science. There is a place for listing other work taken simultaneously with college physics. In the upper right-hand corner of the card, there is reserved for the instructor's entry the section number, the instructor's initials, and the grade for the quarter. On the reverse side the efficiency test grades are to be recorded together with the advice given and the action taken by the student.

[1] *School Science and Mathematics*, XX (March, 1920), 227.

From one quarter to another a student may have to shift sections because of conflicts of hours with other courses; this record card then passes through the hands of his successive instructors, who are thus acquainted with his previous work. These cards form the class list of each section and at the end of the course go into a permanent file. Thus we acquire from year to year much statistical information of value in answering requests for recommendations and in scrutinizing collectively the work of students who come from different local high schools.

Name Year_____ Courses Instructor Grade

_____ _____ _____
Surname First Name Initial

Age_____ Majors' credit in University_____

Classification_____(Ph.B., S.B., M.D., etc.)

High school physics_____, _____years ago_____textbook
Name of School

High school mathematics courses_____

College science courses_____

College mathematics courses_____

Reason for initial registration_____

_____

Other courses taken this quarter.....
1st qr._____
2d qr._____
3d qr._____
4th qr._____

Hours of outside work_____

These records are, of course, accessible to any of the teachers interested in them, and they do much toward furthering co-operation between the University and the secondary schools in this field.

We come now to the matter of the efficiency test. The general type of test given may be found in *An Introduction to Laboratory Physics* by Lucius Tuthill. A few questions of the type employed are presented on page 385 with the record of achievement of a recent section.

It will be seen that the questions have no bearing on the general intelligence of the individual but deal merely with technical matters

of mathematical preparation and high-school training in physics. We propose to include some questions from general intelligence tests in the future to see if more satisfactory results are obtained. A very important point made by Tuthill is that questions should be of such a type that the student does not have to "stop and think" about them. If he cannot answer immediately, he is told to pass on to the next question.

Question	Percentage of Students Answering Correctly
1. What per cent is .008?	90
2. Simplify $\frac{\frac{3a}{b}}{\frac{a}{3b}}$	85
3. Solve for x: $\frac{3}{x}=\frac{8}{16}$	95
4. Solve for x: $3:x::8:6$	85
5. $a^5\times a^2=?$ $a^5+a^2=?$ $a^5\times a^2=?$ $(a^2)^3=?$ $(a^3)^2=?$	60
6. If $\frac{c}{e}$=constant, what change must take place in c if e is doubled?	75
7. Given $y=ax+c$; a and c are constants. When $x=0$, $y=?$	50
8. Which is larger: $\frac{54}{129}$ or $\frac{55}{130}$?	85
9. Divide 0.012 by 0.0024	85
10. x feet$\div y$ secs.$=?$	10
11. Define acceleration	30
12. Work required to push 500 lbs. up inclined plane rising 1 ft. in every 10 ft. of slope, if plane is 15 ft. long?	40
13. What is meant by potential energy?	35
14. If the 500 lb. weight is lifted straight up to top of plane, work$=?$	80
15. State Ohm's Law and give meaning of each term	30

The first meeting of each course consists primarily in filling in the information card and writing the efficiency test. After the second meeting, which adjourns early for the purpose, the instructor calls up for conference all who fall below some predetermined grade or, perhaps better, the lowest third of the section. These he interviews individually and makes his first personal contacts in a spirit of helpful and kindly inquiry. He gives advice where his judgment dictates, but forces no action, leaving the matter entirely to the discretion of the student. Frequently the other

information on the card enables one to give precisely that advice with which the student enthusiastically concurs. If a change of class or course seems best, the dean is advised of the fact by note from the instructor. The student is not required to follow the instructor's suggestion if he does not readily agree.

Some statistics of last year's classes may be of interest. Of 171 registrants, 40 made a score of less than 50 per cent on the efficiency test and were interviewed; 22 agreed that they were not prepared for college physics and dropped out at once with a loss of but one hour's time in entering another class. Many of these requested advice as to what they should take and acted directly in accordance with it, some going back into preparatory physics, others taking elementary courses in mathematics, some going into chemistry. The remaining 18 students were all warned as to the importance of carefully scrutinizing their reactions in the first few weeks and were advised to make special effort. Of these 18, 9 successfully completed the course; 9 dropped the course within four weeks because of obvious failure to continue with a passing grade. In the last four weeks several other students dropped the course, but these cases were almost without exception due to conditions arising late in the quarter, mostly because of illness, conditions which interfered with the rest of their work as well as with physics.

Thus it is brought about that before two days have gone by in a new quarter, the lowest third, as determined in this fashion, has been brought under scrutiny and a sympathetic acquaintance established. These pupils feel an immediate sense of responsibility and, if other difficulties develop, go at once to the instructor. Frequently, his advice, not taken the first time, is eagerly sought later, and the spirit of co-operation grows. Cases that appear unusually difficult may be referred to the departmental adviser or the dean. In short, the student who needs help is not lost sight of.

Of course, the real test of any scheme is how it appears to work out. To answer this question the records of previous years have been studied and the following comparisons noted. During the years 1910–14 the first course in general physics comprised eight sections with 133 students, 17 per cent of whom were conditioned

or failed. During the years 1914–18, representing considerable growth but as yet no very systematic method of administration, there were seventeen sections with 344 students, 14 per cent of whom were conditioned or failed. During the years 1918–20, representing again a doubling of numbers, there were seventeen sections with 333 students, 6 per cent of whom were conditioned or failed.

The system described was started about the beginning of this last period. The 6 per cent includes the unusual number of poor students who were enrolled during the period of disturbed conditions of work that followed the war. Had this condition not existed, there would have been an even lower percentage of failures.

Our own inquiry, "Is there really any benefit derived from this systematic method of keeping in touch with and of testing the student other than that of having him pigeonholed for future reference?" appears to be answered in the affirmative, and the system will be continued for the present.

Meanwhile, another question comes up. We seem to be forecasting failures to some extent. Are we by this means forecasting the other grades of work to any appreciable degree? The present reply to this is that there does not seem to be a great enough degree of correlation to warrant discussion. It is probable that tests of the type outlined are not as effective in forecasting grades as in indicating probable failures. Further study on this point is in progress and will be reported in this journal later.